



**ENGINEERING REPORT
EXISTING WASTEWATER
TREATMENT SYSTEMS
LIGHTOLIER
FALL RIVER, MASSACHUSETTS**

PREPARED FOR:

Lightolier
Fall River, Massachusetts

PREPARED BY:

GZA GeoEnvironmental, Inc.
Providence, Rhode Island

January 2008
File No. 33352

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January 10, 2008
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Massachusetts Department of Environmental Protection
Southeast Regional Office
20 Riverside Drive
Lakeville, Massachusetts 02347

Re: BWPIW 38 Sewer Connection Permit Application
Existing Wastewater Treatment System
Lightolier
Fall River, Massachusetts

140 Broadway
Providence
Rhode Island
02903
401-421-4140
Fax: 401-751-8613
www.gza.com

Dear Sirs/Madam:

On behalf of our client, Lightolier, GZA GeoEnvironmental, Inc. (GZA) is pleased to submit the enclosed BWP-IW 38 Sewer Connection Permit Application for the facility located at 631 Airport Road, Fall River, Massachusetts. We have also attached supporting information in the form of a bound Engineering Report that includes a description of the facility, drawings, analytical data, and other relevant information. A check in the amount of \$1,605 and completed transmittal form has been submitted to the Department of Environmental Protection office in Boston, Massachusetts.

Please contact us should you have any questions.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Igor Runge, Ph.D., P.H.
Senior Project Manager

John J. Spirito, P.E.
Project Reviewer

Philip P. Virgadamo, P.E., LSP
Principal

IR/PPV:clz

Attachments: BWP-IW 38 Application and Engineering Report

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1.00 INTRODUCTION AND SCOPE OF WORK

GZA GeoEnvironmental Inc. is pleased to provide this engineering report and industrial sewer connection permit application for an existing sewer connection at Lightolier/Fall River, Fall River, Massachusetts. This report has been prepared in accordance with the Limitations presented in Appendix A.



Lightolier operates a lighting fixture manufacturing facility at 631 Airport Road in Fall River, Massachusetts. The site is located in the Fall River Industrial Park and consists of approximately 37.9 acres of land occupied by an approximately 326,000 square-foot manufacturing/office building. Lightolier (formerly named Lightolier/Aluminum Processing Co.) has operated a lighting fixture manufacturing facility at the site since January 1973. The land and building are owned by Lightolier. Lightolier's water supplier is the Fall River Water Department. Sanitary sewer and industrial waste water discharges are to a Publicly Owned Treatment Works (POTW) under Fall River Sewer Commission Permit #355, issued July 1, 2007 (Appendix B).

The Bureau of Waste Prevention of the Massachusetts Department of Environmental Protection (MassDEP) has instituted regulations aimed at controlling commercial, industrial, and institutional wastewater discharges. For major sewer connections, legislative authority is stated in Massachusetts General Laws Chapter 21, Section 43 and regulatory authority is stated in 314 CMR 7.00. In February 1999, MassDEP approved the renewal of Sewer Connection Permit Number S99CI002A/69541, authorizing Lightolier's continued discharge of industrial wastewater to the Fall River POTW.

On January 12, 2007, MassDEP amended its regulations governing sewers in an effort to streamline state approval requirements for sanitary sewer connections and extensions, and industrial wastewater sewer connections. We understand that these revisions were intended to reduce duplication of federal and local requirements and enhance existing performance standards. The revisions also were adopted to allow MassDEP to focus its resources on discharges directly into surface and groundwater, industrial discharges to sewers involving large volumes of wastewater and/or toxic chemicals, sanitary sewer overflows, and infiltration of groundwater into sewers. MassDEP has indicated that existing dischargers such as Lightolier must file for the requisite Permit by January 12, 2008.

Lightolier's manufacturing processes have not changed significantly since the renewal of MassDEP Permit No. S99CI002A/69541 in 1999. Improvements since that time include:

- Installation of a Three-Stage Powder Coat Line Washer System in 2004;
- Installation of a third Anodizing line in 2006;
- Elimination of BCR 123 DiLimonie, a citrus-based cleaning agent used in the anodizing cleaning process.

This report documents the production processes that potentially impact the quality of Lightolier's process wastewater. The scope of work for this project involved completion of the following major activities:

- A facility tour, including a review of the existing industrial wastewater treatment system and operator interviews;
- Updating plans and specifications for the existing treatment system (based on information provided by Lightolier), and preparation of this report;
- Preparation of MassDEP Form BWP IW-38 & BWP IW-39, Permit for Industrial Sewer User (Appendix C), and supporting forms.



2.00 BACKGROUND

Lightolier is a major manufacturer of high-end lighting fixtures, with manufacturing and distribution facilities located in California, Connecticut, Georgia, Illinois, New Jersey, Massachusetts, Texas, and Mexico. The company is headquartered in Fall River, Massachusetts. The headquarters building contains the corporate offices, as well as the manufacturing operation for commercial and residential recessed lighting fixtures.

Lightolier has been manufacturing lighting fixtures at the Fall River facility since January 1973. The manufacture of these recessed fixtures involves pressing or spinning aluminum sheet stock to form a fixture base. Next, the formed bases are washed, after which they either are painted, anodized, or powder coated. Electrical assembly kits are installed on the finished bases, and the complete fixture units are packaged for shipment to distribution centers.

2.10 MANUFACTURING FACILITY DESCRIPTION, PRODUCTION, OPERATIONS

The Fall River facility operates 240 to 300 days per year, two shifts per day, with a 30-minute lag between the two shifts to allow the parking lot to clear. Both shifts are 8 to 10 hours in length, for a total of 16 to 20 operational hours per day. The manufacturing facility employs approximately 450 full-time workers. An additional 175 full-time employees are assigned to the corporate offices.

Production levels at Lightolier are measured in the number of lighting fixtures produced per day. When operating at maximum capacity, the facility can produce 24,000 fixtures per day; however, the Fall River plant typically produces approximately 20,000 lighting fixtures per day.

The calculations and flow rates contained in this report are based on the above operational parameters.

2.20 RAW MATERIAL USAGE AND MANUFACTURING PROCESSES

Lightolier is a vertically integrated manufacturing facility. That is, all steps required to produce a finished product are completed on the premises.

The major raw materials used in fixture production at Lightolier include aluminum sheet stock, anodizing chemicals, wash system chemicals, painting and coating products, and forming lubricants. Sections 2.21 through 2.25 summarize the major wet processes—those that require the use of water—and the primary raw materials currently utilized in those processes.



2.20.1 Aluminum Sheet Stock Forming Operation

Two forming operations are utilized at Lightolier: spinning and hydroforming. Spinning operations are conducted on an electrically powered lathe which forms an aluminum disk into the desired fixture shape. Hydroforming operations involve the use of hydraulic presses to form the disk into the required shape. The hydraulic presses, which are water-cooled, are the primary source of non-contact cooling water at the plant. Non-contact cooling water is recycled as described in Section 2.32.

Forming operations require the use of lubricants to protect the surface of the aluminum stock. A variety of lubricating oils are used in the fabrication processes, and Lightolier continually strives toward replacing petroleum-based lubricants with water-soluble or synthetic products.

2.20.2 Surface Preparation – Aqueous Washing

Residual lubricants, fingerprints and other residues must be removed from the surface of the formed bases prior to painting, anodizing or applying a powder coating. This is achieved through the following processes:

- Three Stage Aqueous Washing line
- Three-Stage or Five-Stage Powder Coat Line Washer system
- Cleaning Stage of the Anodizing line

The cleaning process selected depends on the desired finish. The primary chemicals utilized during the cleaning process include potassium hydroxide, sodium hydroxide, and phosphoric acid.

2.20.3 Anodizing Process

Anodizing is one of three finish processes utilized at the Fall River facility. Anodizing protects and cosmetically enhances the surface of the fixtures. The primary chemicals used during the anodizing process include sodium hydroxide, phosphoric acid, sulfuric acid, and nitric acid. Nitrate compounds are generated during the process.

2.20.4 Maintenance Operations

Routine maintenance operations include activities such as the cleaning and washing of equipment and parts. Chemicals used for routine maintenance include Boraxo Hand Soap, floor sealer, and aluminum tapping compounds (cutting oil).



2.30 RAW WATER SUPPLY AND USAGE

Raw water is supplied by the Fall River Water Department. Average daily raw water consumption is approximately 282,230 gallons per day (gpd), reflecting the daily average collected over a recent six-month period (May through October 2007). The majority of this water is used in production processes, after which it discharges to a two-stage pH Neutralization system for treatment prior to discharge to the POTW.

Between 90,000 and 100,000 gallons of the average daily raw water consumption is utilized in forming operations. This water is used to cool the hydraulic machinery via heat exchangers. Lightolier has 34 hydraulic presses, 11 of which are large, two-story high "Version" or "Cincinnati" hydroform presses, and 23 of which are manually operated presses.

This non-contact cooling water is collected and recycled to the anodizing process, with the flow feeding into the eight anodizing scrubbing towers, where a small quantity is lost through evaporation. Water from the scrubbers discharges to the anodizing pit, ultimately discharging to the two-stage pH Neutralization system for treatment prior to discharge.

3.00 DESCRIPTION OF PRINCIPAL WET PROCESSES

The principal wet processes utilized at Lightolier include the following:

- Three-Stage Washer: for cleaning fixture bases (wash-rinse-rinse);
- Three-Stage Powder Coat Line Washer system: for cleaning fixture bases prior to powder coat/painting, (wash-rinse-wash);
- Five-Stage Powder Coat Line Washer system: for cleaning fixture bases prior to powder coat/painting, (wash-rinse-wash-rinse-rinse);
- Anodizing lines: for anodizing and dyeing fixture bases;
- Buffing Dust Scrubber System: a wet air-pollution scrubbing system used for collecting the dust generated in fixture buffing and polishing operations; and,



- Miscellaneous Processes: other manufacturing-related operations, including
 - Boiler Blowdown
 - Compressor Condensate
 - Maintenance/Cleaning

The following sections describe each wet process in detail. Figure 1 depicts the overall industrial wastewater flow schematic for all wet processes.

All process waste water that is not recycled discharges to the Two-Stage pH Neutralization system at some point during the process. The pH Neutralization system is described in Section 3.70.

3.10 THREE-STAGE WASHER

The Three-Stage Washer consists of a conveyor system which transfers the fixture bases through a wash step (Tank 1) and two rinse steps (Tanks 2 and 3).

3.10.1 Description of Three-Stage Washer Operations

Tank 1 consists of a 1,350-gallon tank which uses a sprayer to wash the conveyed fixture bases. Tank 1 batch discharges once weekly. A phosphate cleaner containing sodium metasilicate and tetrasodium pyrophosphate is used in this tank at a concentration of 2 ounces per gallon (oz/gal) of water.

Tanks 2 and 3 are operated as countercurrent flow rinses (counter to the flow of work). Fresh water feeds into Tank 3 through an overhead sprayer. Tank 3 discharges to Tank 2's overhead sprayer. Tank 2 discharges over a weir to the pH Neutralization system. Both Tanks 2 and 3 have a 750-gallon capacity with a typical flow rate of 8 to 9 gallons per minutes (gpm). The maximum discharge rate is 10 to 12 gpm.

3.10.2 Quantity of Wastewater Discharging to pH Neutralization System

In summary, the average continuous discharge rate is 8 to 9 gpm, with a maximum rate of 10 to 12 gpm. Additionally, 1,350 gallons are batch-discharged on a weekly basis.

3.20 FIVE-STAGE POWDER-COAT LINE WASHER

The Five-Stage Powder-Coat Line Washer is a process in which the fixture bases are washed (Tank 1), rinsed (Tank 2), treated (Tank 3), rinsed (Tank 4), and rinsed again (Tank 5).

3.20.1 Description of Five-Stage Powder Coat Line Washer

Tank 1 is a 1,000-gallon capacity tank that batch discharges every two to four weeks to the pH Neutralization system. Tank 1 contains approximately 2 oz/gal of a potassium hydroxide solution.



Tank 2, with a 450-gallon capacity, has a continuous-feed overhead sprayer that feeds at a rate of 6 to 8 gpm. Discharge from Tank 2 is piped directly to the pH Neutralization system.

Tank 3 has a capacity of 1,250 gallons and contains a phosphoric acid and hydroxylammonium sulfate compound, added at a concentration of approximately 2 oz/gallon. It is batch discharged every two to four weeks to the pH Neutralization system.

Tanks 4 and 5 are run as countercurrent rinses, with a spray jet input of clean water into the top of Tank 5, the discharge from which feeds the overhead spray jet to Tank 4. Tank 4 discharges to the pH Neutralization system at a flow rate of 4 gpm. Each tank has a capacity of 450 gallons.

3.20.2 Quantity of Wastewater Discharging to pH Neutralization System

In summary, the average continuous discharge rate from the Five-Stage Powder Coat Line Washer is 10 gpm, with a maximum rate of 12 gpm, from tanks 2 and 4. Tank 1 batch discharges 1,000 gallons every two to four weeks. Tank 3 batch discharges 1,250 gallons every two to four weeks.

3.30 THREE-STAGE POWDER-COAT LINE WASHER

The Three-Stage Powder Coat Line Washer, installed in 2004, is a process in which the incoming fixture bases are washed (Tank 1), rinsed (Tank 2), and rinsed again (Tank 3).

3.30.1 Description of Three-Stage Powder Coat Line Washer

Tank 1 is a 200-gallon capacity tank that batch discharges every two to four weeks to the pH Neutralization system. Tank 1 contains approximately 2 oz/gal of a potassium hydroxide solution.

Tanks 2 and 3 are run as countercurrent rinses, with a spray jet input of clean water into the top of Tank 3, the discharge from which feeds the overhead spray jet to Tank 2. Tank 2 discharges to the pH Neutralization system at a flow rate of 3 to 6 gpm. Each tank has a capacity of 200 gallons.

3.30.2 Quantity of Wastewater Discharging to pH Neutralization System

In summary, the average continuous discharge rate from Three-Stage Powder Coat Line Washer is 3 to 6 gpm. Batch discharges from Tank 1 occur every two to four weeks, at a volume of 200 gallons per batch.

3.40 ANODIZING

As shown in Figure 2, the anodizing operation is contained in a single "pit" which receives all tank overflow discharges from the entire anodizing process and collects them in a common sump. The overflow then is pumped to the pH Neutralization system. Additional system discharges such as controlled (heated or cooled) rinses are hard piped directly to the first stage of the neutralization system.



3.40.1 Description of Anodizing

The entire anodizing system consists of three separate lines: Line No. 1 operating Tanks A1-A21, Line No. 2 operating Tanks B1-B36; and Line No. 3, which operates Tanks T21-T29. Line No. 3 was installed in 2006.

The first stage of each line features a loading rack station where the fixture bases, hanging on racks, are loaded onto an automatic conveyor system. The conveyor moves the racks through the various process sequences to achieve the desired finished product. Figure 2 features a flow diagram of the Anodizing system.

The key steps in the anodizing process are cleaning, etching, nitric de-smut, bright dipping, anodizing, dyeing and sealing. These operations are described as follows.

Cleaning

The cleaning step removes any remaining metal oxides, stamping and forming oils, buffing compound, or general surface contaminants to ensure that a pure base metal is presented to the next step in the process. The bath consists of a water and phosphoric acid solution. This process previously used BCR 123 DiLimonie, a citrus-based cleaning agent. The elimination of BCR 123 DiLimonie has reduced total facility volatile organic compound (VOC) emissions by 47 percent. With the elimination of the use of BCR 123 DiLimonie, no other wet processes at the Lightolier facility produce VOC emissions.

Etching

The process of caustic etching is utilized when an etched surface is desired. Caustic etching allows for further blending of surface imperfections on the aluminum base surface. The etching bath consists of water and sodium hydroxide.

Nitric De-Smut

This step is performed after the caustic etch to remove deposits of metals and metal oxides from the fixture surface. The bath consists of water and nitric acid.



Bright Dip

Bright dipping increases the brilliance or brightness of the aluminum by leveling the microscopic roughness on the fixture's surface. This is achieved by exposing the fixture to a heated bath consisting of phosphoric acid, nitric acid, dissolved aluminum, fume suppressants, and water.

Anodizing

Anodic oxidation, or "anodizing," is an electro-mechanical process for thickening the natural oxide coating found on aluminum. This thicker oxide coating is more resistant to corrosion and abrasions than either the underlying aluminum or aluminum with only a natural oxide coating. Further, the anodize coating is porous and allows for the absorption of dyes. The primary bath ingredients are sulfuric acid and water.

Dyeing

During the dyeing process, the fixture base is immersed in a bath consisting of de-ionized water and an organic or inorganic dye, allowing the porous, anodized coating to absorb the dye.

Sealing

Sealing, the final step, increases the corrosion resistance of the anodic coating, removes residual acidic contaminants, and partially plugs the pore openings of the anodic coating. The primary bath ingredients are a sealing additive and hot water. This process converts a portion of the anodic film into an aluminum hydrate, thereby protecting the fixture surface.

3.40.2 Quantity of Wastewater Discharging to pH Neutralization System

The average continuous discharge rate from the anodizing operation is approximately 190 gpm.

3.50 BUFFING DUST SCRUBBER SYSTEM

The buffing dust scrubber system consists of a vertical cyclone type scrubber and a gravity-fed paper roller filter.



3.50.1 Description of Buffing Dust Scrubber System

Buffing dust, collected by the an exhaust system in the buffing department, passes through a diameter increase of 8:1, where water is sprayed in at the top and the air/dust exhaust enters at the bottom (counter current scrubbing). The water removes most of the particulate matter from the air. The cleaned (scrubbed) air is exhausted to the atmosphere. The water is recycled through the use of a roller filter and returned to the scrubber.

The roller filter uses a roll of paper filter media to remove particulates from the water. The paper filters are disposed of as solid waste.

The input stream is city water. The volume of water entering the scrubbing system is controlled by a float valve which maintains the tank at a specified level. The tank receives the permeate and feeds the spray nozzle for the scrubber.

3.60 MISCELLANEOUS PROCESSES

The following paragraphs briefly describe three miscellaneous processes at Lightolier: boiler blowdown, compressor condensate, and maintenance operations. These processes are illustrated on Figure 1. All discharge to the pH Neutralization system.

3.60.1 Boiler Blowdown

Effluent from boiler blowdown discharges to the pH Neutralization system in 50-gallon batches at an approximate rate of one batch per day.

3.60.2 Compressor Condensate

All compressor condensate enters a gravity-feed oil/water separator. Oil is removed from the separator and disposed of weekly. Effluent water is piped to the pH Neutralization system at a rate of 10 gallons per day (gpd).

3.60.3 Maintenance

Maintenance operations vary and are performed on an "as-needed" basis. Waste water from maintenance operations is discharged to the pH Neutralization system.

3.70 DESCRIPTION OF pH NEUTRALIZATION SYSTEM

All process waste water that is not recycled discharges to the two-stage pH Neutralization system, depicted in Figure 3. The treated effluent discharges from the pH Neutralization system to sewer outfall No. 3 on Sykes Road, as indicated on Figure 4.

The pH Neutralization system receives waste water from the Three- and Five-Stage Powder Coat Line Washers, Three-Stage Washer, Anodizing lines, and the miscellaneous processes described above. The pH Neutralization system is a continuous-flow, two-probe, two-stage



system consisting of a divided floor pit outfitted with a static baffle to provide flow control. The pit is 6 feet wide by 12 feet long, divided into two 6-foot sections by a baffle, with a maximum depth of 6 feet 9 inches. The maximum volume is 3,635 gallons; however, under normal operation, the pit is filled to a depth of 6 feet 6 inches (3,500 gallons). The pit is concrete lined, recessed in the floor, and receives industrial effluent at the following rates:

- 1) Three-Stage Aqueous Washer: 8 to 9 gpm average and 10 to 12 gpm maximum discharge from Tank 2; 1,350-gallon batch discharge weekly from Tank 1.
- 2) Five-Stage Powder Coat Line Washer: 10 to 12 gpm total from Tanks 2 and 4; 1,000-gallon batch discharge every two to four weeks from Tank 1; and 1,250-gallon batch discharge every two to four weeks from Tank 3.
- 3) Three-Stage Powder Coat Line Washer: 3 to 6 gpm from Tank 2; 200-gallon batch discharge every two to four weeks from Tank 1.
- 4) Anodizing lines: approximately 190 gpm.
- 5) Gravity-Feed Oil/Water Separator (compressor condensate) 10 gpd.
- 6) Boiler Blow Down: 50-gallon batch/day.

All effluents enter the upstream side of the pit, where they are mixed mechanically with either sodium hydroxide (50 percent) or sulfuric acid (66 percent). Chemical additions are controlled by a Model RC 75 recorder controller set to add sulfuric acid when $\text{pH} \geq 8.0$, or sodium hydroxide when $\text{pH} \leq 6.0$. pH adjustment chemicals are dispensed automatically by a Liquid Metronics, Inc. (LMI) Model C931 chemical feed pump with an 8-gallon-per-hour capacity. A second LMI Model C931 Chemical Feed Pump is hard piped in series with a bypass loop and ball valves next to the primary feed pump. The LMI C931 pumps serve as the primary sodium hydroxide feed pumps. A Furnas Stainless Steel Control Panel and Disconnect houses the Magnetic Starters for both feed pumps. A selector switch is located in the front panel of this control box. These pumps are permanently wired and piped, and are activated by opening/closing the appropriate ball valves and selector switch. A water-connection valve is located between the two pumps on the bypass loop so that when one pump is selected, the other may be fresh-water flushed. An LMI Model SG pump is controlled by the backup and has a maximum capacity of 75 gallons per hour.

The Model RC 75 pH controller measures pH levels via a probe located at the inflow of the combined industrial effluent. Impellers are located in both chambers, providing continuous mixing. Chemical usage is approximately 150 gpd of 50% sodium hydroxide (stored in two 1,250-gallon containers) and approximately 1 gpd of sulfuric acid (stored in a 350-gallon tote).

After entering the first chamber, waste water flows either over or under the separation baffle into the second chamber, where the pH level is measured and recorded by a Lancy Recorder with an audible alarm. If the pH drops below 6 or rises above 9, the alarm sounds, summoning the system operator(s) who can activate a backup system.

The maximum estimated input/output rate for the pH Neutralization system is 225 gpm, yielding a minimum residence time of approximately 15.5 minutes, after which the treated water discharges through sewer outfall No. 3.

4.00 DESCRIPTION OF REQUIRED EFFLUENT QUALITY

Lightolier is subject to the City of Fall River's Industrial Pretreatment Program. Sanitary sewer and industrial waste water discharges to a Publicly Owned Treatment Works (POTW) under Fall River Sewer Commission Permit #355, which sets forth effluent limitations and monitoring requirements.



Appendix D includes the analytical results obtained for effluent monitoring performed in October, November, and December 2007.

5.00 LIMITATIONS

GZA's engineering report and sewer connection permit application were performed in accordance with generally accepted practices of other consultants undertaking similar projects at the same time and in the same geographical area, and we observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. No other warranty, expressed or implied, is made. This report is also subject to the specific limitations contained in Appendix A.

This application and Report have been prepared on behalf of and for the exclusive use of Lightolier, Fall River, Massachusetts, solely for use in procuring their sewer discharge permit. This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party, nor used by any other party in whole or in part, without the prior written consent of GZA. However, GZA acknowledges and agrees that the Report may be conveyed to state and local regulatory agency.

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